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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/717,603	11/21/2003	Vencent Chang	82471X	8213

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EXAMINER	
SULLIVAN, CALEEN O	

ART UNIT	PAPER NUMBER
1756	

DATE MAILED: 12/07/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/717,603	CHANG ET AL.	
	Examiner	Art Unit	
	Caleen O. Sullivan	1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-20 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-20 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☒ Interview Summary (PTO-413) Paper No(s)/Mail Date. *attached* .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

1. Claims 4-5, 14 and 17 are objected to because of the following informalities: Claim 4 recites "fluorine-base acid," this should be "fluorine-based acid." Claims 5 and 17 use the term "including" in the phrase, " ...wherein said chemical diffusion layer including a second chemical material." This should be "includes." Claim 14 includes extra characters ("F") at the end of lines 3 and 4. These should be removed. Appropriate correction is required.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 4 and 13 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention

Claim 4 is indefinite due to the use of the term "fluorine-base acid," it is unclear what the scope of "fluorine-base acid" is.

Claim 13 is indefinite in reciting, "...baking process 'lasts' about 50 degrees centigrade to 200 degrees centigrade." It appears a temperature range is being claimed and should be recited as such using appropriate language. Appropriate correction is required.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1-20 are rejected under 35 U.S.C. 102(b) as being anticipated by Saito ('832).

Saito ('832) teaches a method of manufacturing a semiconductor device with a fine pattern formed thereon. The method begins with a step of forming a resist pattern on a semiconductor substrate from a chemically amplified photoresist, by irradiation with a KrF laser, and then forming an organic film layer, which produces acid on exposure to light, on the semiconductor substrate including the photoresist layer. (See, col. 6, 19-23). The method includes a second exposure step, which is followed by a heat treatment that causes the acid produced in the organic film, during the second exposure step, to diffuse into the chemically amplified resist patterns, and form a soluble layer. (See, col. 6, 24-28 and 32-46). Then, the organic film and the solubilized layer are removed by an alkaline developer, resulting in shrinkage of the resist patterns that were in contact with the exposed portions of the organic film. (See, col. 6, 47-50 and 56-60).

These teachings in Saito ('832) meet the limitations of claims 1 and 7-8, where a substrate is provided on which a photoresist layer is formed and then exposed to form two photoresist regions. Then a chemical diffusion layer is formed. Next, the entire substrate including the photoresist layer and the chemical diffusion layer is baked. During the baking process the chemical material of the second photoresist region and the chemical material of the chemical diffusion layer react with the chemical material of the first photoresist region. After the baking process a developing step takes place, which results in the line width of the first photoresist region shrinking. Although the steps of the method of claim 14 are recited in an order that is different from claim 1, claim 14 uses the open-ended language "comprising;" therefore, the steps do not have to occur in the order recited and the limitations of claims 14 and 18-19 are also taught by the disclosures in Saito ('832).

The heat treatment disclosed in Saito ('832) is conducted between 60°C-140°C, for 1-3 minutes, which is within the temperature and time ranges recited in claims 11 and 13. (See, col. 6, 39-46). Saito ('832) also teaches that if the temperature or the time of the heat treatment is increased the amount of resist pattern dissolved during the development step is also increased, resulting in shrinkage of the line width. (See, col. 6, 39-46). This disclosure teaches the limitations of claims 9 and 20, where the shrinking line width of the first photoresist region depends on the diffusive rate of the first chemical material. (See, col.6 39-46). Moreover, the disclosure meets the limitations recited in claims 10 and 12, where the shrinking line width of the first photoresist region can be controlled by either the time for baking or by the temperature of the baking process. (See, col.6, 39-46).

Saito ('832) also discloses the organic layer formed on the substrate after the photoresist layer is formed and exposed is a polymer with an acidic component added to it. (See col. 6, 66-col. 7, 2). This disclosure meets the limitation of claims 5 and 17, where the chemical diffusion layer includes a second chemical material. Saito ('832) also discloses acidic components including photosensitive acid generators such as trifluoro-methane sulfonate that can be included in the organic layer. (See col.7, 17-24). The limitation of claim 6 recites the second chemical material of the chemical diffusion layer and the first chemical material, included in the second photoresist region, are the same. Therefore, the example acidic components (See, col.7, 17-24) listed in Saito ('832) meet the limitations of claims 2 and 16, which recite the second photoresist region includes a first chemical material. Moreover, the acidic components listed in Saito ('832) also teach the limitations of claims 3 and 4, which recite the first chemical material is an acid-based and more specifically a fluorine-based acid material. (See, col.7, 17-24).

Claim 15 recites the chemical diffusion layer that is formed on the photoresist layer is transparent. Although Saito ('832) does not disclose the organic film layer, formed on the photoresist layer is transparent, it is inherent that the layer is transparent since the exposure of the underlying layer occurs through the chemical diffusion layer.

Saito ('832) teaches every limitation of claims 1-20.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

8. Claims 14-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Saito ('832) in view of Wheeler ('525).

Saito ('832) is relied upon as discussed in the rejections of claims 1-20 under 35 USC 102 (b) set forth above in paragraph 6. Saito ('832) fails to disclose a method where the photoresist is contacted with a chemical diffusion layer before the resist layer is exposed to radiation and

patterned, which is inferred by claim 14 although the claim language does not recite this ordering. However, a method teaching such an order is disclosed in Wheeler ('525).

Wheeler ('525) teaches a thin layer imaging process for microlithography, which begins with a step of coating a substrate with a layer of resist material that contains a photo acid generator or a photo acid precursor that can generate a photo acid when exposed to light. (See, col.5, 47-52 and Fig. 1). In the next step of the process the resist material is soft baked to remove residual solvent and is exposed to silicon containing environment whereby a layer of silylated resist material is formed. (See, col.6, 23-27 and Fig.2). The silylated resist material is then patterned by passing light through the openings in the mask onto the silylated resist material. (See, col. 6, 51-57 and Fig.3). Next the entire structure is subjected to a post exposure vacuum bake at a temperature of about 120°C, which leaves a resist surface that is composed of silylated and unsilylated regions. (See col. 7, 10-17 and Fig.4). Then the resist material is etched by a conventional etching step such as an Oxygen plasma etch. (See, col.6, 21-26).

The silylation steps disclosed in Wheeler ('525) meet the limitations of claim 14, where a chemical diffusion layer is formed on a substrate, over a layer of photoresist formed on the substrate. Then the substrate including the photoresist layer is exposed through the chemical diffusion layer to form first and second photoresist regions. Next the substrate including the exposed photoresist layer and the chemical diffusion layer is baked and developed.

Although, neither Saito ('832) nor Wheeler ('525) disclose the film layer, formed over the photoresist layer is transparent, it is inherent the layer is transparent since exposure of the underlying layer occurs through this chemical diffusion layer.

It would have been obvious to one of ordinary skill in the art at the time of invention by applicant to combine the teachings of Saito ('832) with the teachings of Wheeler ('525) in order to

achieve a lithographic method capable of producing submicron features, because Wheeler teaches that contacting a layer of photoresist with a silicon environment before exposing the photoresist to form patterns, creates areas in the resist material that are more easily removed because they are diffused with a material layer that decreases etch resistance or increases solubility in developer, resulting in a reduced line width of the photoresist regions after development.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Caleen O. Sullivan whose telephone number is 571-272-6569. The examiner can normally be reached Monday-Friday, 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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11-13-06

KD

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